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GasVac® 305

WITH OPTIONAL CAN SENSORS

SEQUENTIAL SAMPLING UNIT
1 - 48 WAY
OPERATING HANDBOOK

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SYSTEM OVERVIEW

The GasVac 305 is designed to be used in a safe area, external to the area being monitored for potential hazardous conditions. It may have 1-48 sample lines, measuring up to 4 different gases whilst checking for alarm conditions. Each channel consists of a sample line which is routed to the point where the gas is to be sampled. A vacuum pump draws the gas to the sensors on an individual line basis via a solenoid valve which is activated by the main computer board. Each channel has its own sample time which is based upon the length of the sample pipe. This can be set by the user.

Pipe blockages are detected as flow failures resulting in an automatic blowback system attempting to unblock a pipe. Additionally, the pump itself is monitored and total pump failure is indicated.

The main computer board controls most actions. With an LCD display it is capable of indicating the state of sampling or fault conditions. Likewise, dimmable LED's and relays give additional displays of the system state. Many parameters are programmable and are retained when power is off, in a non-volatile memory chip. These parameters are reloaded at the next power up so that the system will perform as previously set.

A real time clock keeps track of time and this time value is appended to any panel events such as alarms or faults, etc. The events are retained in a 99 event memory which can be viewed on the LCD or sent to a PC via the RS232 channel.

The RS232 channel can also accept parameters from a PC and if needed, can send the panel's parameters to the PC. Using simple text files, these can be edited and sent back to the panel.

In addition to 4 gasses, a 5th optional, flammable, cabinet only gas is monitored in the panel and will cause power shutdown if it goes into alarm, preventing the possibility of local gas ignition.

For systems consisting of less than 48 sample lines, the unconnected valves at startup are detected and removed from the sampling sequence. Subsequent valve coil failures are detected and flagged as an error.

Engineering and User mode menus are available via password entry and allow parameter changes and system checks to take place. Button usage can also be protected by a Key lockout connection. However, muting the buzzer which sounds if an event occurs can still be silenced by pressing any key.

Reset is normally allowed at any time by pressing the reset button, but by fitting a link on the PCB, reset will only operate when the user or engineer's password has been entered.

The power fail relay can be used as a sounder driver and will energise on new alarms. Reset will reset the relay and silence the sounder.

GENERAL SPECIFICATION

Power supply	230/115v AC ±10% Power 300w maximum See equipment test certificate or rating label
Sample points	1 – 48
Outputs	Relays: Global Low Alarm - S.P.C.O Global High Alarm - S.P.C.O Global Fault - S.P.C.O Flow Fail - S.P.C.O Cabinet Gas - S.P.C.O Power Fail / Global Alarm - S.P.C.O RS232 Modbus (RS485) 4-20mA analogue output per sensor – 250ohms max load
Sensors	1 – 4 Direct electrochemical, infrared, specials 1-8 CAN Sensor (optional)
Measurements	Combustible gas - LEL % vol. Toxic gas - ppm % vol. Oxygen - % vol. Refrigerant - ppm SEE PAGE 11 FOR FULL LIST OF GASES
Alarm setting	2 low/high fully adjustable between zero and full scale Normally latched – auto reset option available
Audible alarm	Low, high, fault, flow fail – 98dB @ 38cm
Ingress protection	IP64
Dimensions	W: 600 x H: 800 x D: 350 (mm)
Weight	65kg
Fixing details	Wall mount 4 x 8mm
Sample lines	Material – nylon, PTFE, stainless steel, copper Size – standard 8mm OD (6mm ID) Maximum length 200m – (Special Option: 200m+) Couplings – standard – push fit
Vent lines	2 x 10mm compression coupling
Environmental – IP64	Operating temp -5 to 40°C Storage temp -5 to 50°C Humidity range 0 to 90% RH

Options

Indicator Panel	48 way LED indicator panel
Line blockage	Operating pressure – 2 bar
Blow back	Maximum input pressure to regulator – 28 bar
Cabinet sensor	Combustible LEL – Power shut down
Additional relays	2 x 32 relay board - Event addressable - see pg.10

LCD AND LED INDICATORS (without CAN sensors)

A 4 line 40 character LCD displays a range of information. Below is a typically readout from the display.

```
Sampling 1 for 9 sec     Gas 1 = 0.0       %LEL
Line 2 – Editable text   Gas 2 = 20.8      O2%
Cabgas 2.0 %LEL SQ=27    Gas 3 = 0.0       COppm
16:24 Mon 23 Jul 2012    Gas 4 = 0.0       H2Sppm
```

The top line indicates which of the 48 pipes is currently being sampled and a countdown in seconds indicates when the reading of the gas sensor will take place.

Each of the latest 4 gas readings are shown together with the units of the measurement and pressing HOLD will keep sampling this line for a period of time.

The second line on the LCD shows a text description of the pipe locations and this can be edited as required. (See user engineer section)

The local flammable gas measurement is called "Cabgas" and line 3 indicates its %LEL value. A high alarm is preset to 30% on this measurement and will cause the Cabgas relay to de-energise. Normally this will be wired so that the panel will shut down completely. Optionally this alarm can be wired to energise the cabgas relay when the %LEL value falls below 20%.

Line 4 shows the internal clock reading together with the day and date. All internal events use this clock to record the time of the event.

If an alarm or fault event occurs, the clock display is substituted with the text for this event and will alternate every few seconds or so, if the text is lengthy, but should remain readable. This text which describes the event (e.g. main power lost) is also the same text that is stored in the event log which can be viewed separately. (See Event Log).

LCD AND LED INDICATORS (with CAN sensors)

A 4 line 40 character LCD displays a range of information typically shown below.

```
01  ..............     1:16.8    FLM%LEL
T003 V21 CG00 A00 F00  2:15.0    FLM%LEL
Sampling               3:15.0    FLM%LEL
0:59 Wed 4 Jun 2014    1*15.4    FLM%LEL
```

The top line indicates which of the 48 pipes is currently being sampled and shows the text associated with the location.

Pressing HOLD will keep sampling this line for a period of time.

To the right hand side is a display of one of the possible 12 sensors that can be connected.

Each of the latest gas readings are shown together on the right hand side of each of the four LCD lines and if only 4 sensors are connected then they remain fixed but for more than four, the display will scroll between them.

Direct connected 4-20mA sensors are indicated with a ":" mark

CAN connected sensors display the "*" character.

The second line on the LCD shows various parameters as follows:

T003 would indicate 3 seconds left of sampling. This will count down.

V21 indicates that 21 valves have been detected at power up.

CG is a display of the current Cabgas value in %LEL.

A00 represents the number of alarms present.

F00 represents the number of faults present.

A Cabgas high alarm is preset to 30% on this measurement and it will cause the Cabgas relay to de-energise. Normally this will be wired so that the panel will shut down completely. If it is not wired so then this alarm will energise the cabgas relay when the Cabgas LEL level falls below 20%.

Line 4 shows the internal clock reading together with the day and date. All internal events use this clock to record the time of the event.

If an alarm or fault event occurs, the clock display is substituted with the text for this event and will alternate every second or so, more if the text is lengthy readable. This text which describes the event (e.g. main power lost) is also the same text that is stored in the event log which can be viewed separately. (see Event Log).

The LED's local to the panel are as follows:

Hi Alarm	RED	On if any sample line currently has a high alarm
Low Alarm	RED	On if any sample line currently has a low alarm
System fail	AMBER	On if an internal panel fault has occurred
Flow fail	AMBER	On if any sample line is blocked or has been blocked
Comms Fail	AMBER	On if the Modbus master or CAN Repeater is not communicating
Sensor Fail	AMBER	On if the local Cabgas sensor or any of the 4 gas sensors has failed electrically, e.g. its input is too low or high.
Skip	AMBER	On if any of the 48 sample lines has been set to be skipped ie during maintenance Note: If no valve fitted this is not a skip.
Hold	AMBER	If the sample being taken has been put on hold then this led will come on.
Sampling	GREEN	When normal sampling is in progress then this LED is on. Note some engineering functions stop sampling and the LED will go out during the function and then back on again when completed.
System healthy	GREEN	The processor is functioning correctly
Standby Power	GREEN	The standby power contact is closed indicating that standby power is in use
Main Power	GREEN	The standby power contact is open indicating that main power is in use

These two power LED's are linked and when one LED is on, the other is off. It indicates where power is currently being drawn from.

BUTTONS

8 user buttons are provided on the front panel to allow control and setting up of the sampling system. Also pressing any button will mute the buzzer.

Button 1 is the **UP** button. Used when setting items in user or engineer's menu.

Button 2 is the **HOLD** button which puts the current line into hold. The display will count down the long release timer in seconds which ensures that the line is never continuously on hold. Pressing **HOLD** again will release back to normal sampling.

If the sampling time for the line has expired, the sample will go to the next line in sequence.

Button 3 is the **SELECT** button. It is used to go into or return from a user or engineer's menu. Pressing this button in normal mode prompts the entry of a 4 digit password which will allow entry into user or engineer's menu.

Button 4 is the **SCROLL** button. Pressing this moves the line being sampled on to the next available line. Holding the button down will allow continuous scrolling until the desired line is reached and when released, the line is put on hold.

Button 5 is the **DOWN** button. Used when setting items in user or engineer's menu.

Button 6 is the **DIM** button. It is used for dimming the LED's and will toggle between full brightness and the dim level previously set in the engineer's menu.

DIM can be used at any time except when doing an LED test whereby automatic dimming occurs to reduce current.

Button 7 is the **ENTER** button. It is used when in user or engineer's menu.

Button 8 is the panel **RESET** and is used to clear faults or alarms. It is active after entering user or engineer menu via passwords when the m/f terminals are shorted. Otherwise **RESET** can be pressed anytime. (Later PCB's have a link marked as MENU/NORMAL).

Note: Individual sample line alarms are cleared when the next sample of gas is lower than the set alarm level. This may take some time depending on how many sample lines are in use. The global alarm relays will stay energised until all alarms are clear.

Additionally, a processor reset button and a flash programming slide switch are situated directly on the PCB and are not accessible from the front panel.

Processor reset when pressed, will restart the processor as if just powered up and should only be used in the event of a system crash.

The slide switch should be in the run position for normal operation.

To prevent unauthorised use of the buttons, key lock input is provided on the mains processor PCB (marked K/L) and the buttons are locked out of use when this terminal is connected to 0V (adjacent terminal).

Note: Even when locked, the buzzer can still be muted by pressing any button.

ENTERING A PASSWORD TO GET TO USER OR ENGINEER MODE

System parameters can be altered but not by unauthorised people.

Two passwords have to be entered to gain access to available menus which allow changes to be made. The first 4 button password gives access to the User menu a limited set of menus, e.g. clock set, led test etc. The second 4 button password is the Engineer's password which gives access to all menus including the users.

The 8 buttons internally are numbered 1 to 8 and the sequence of 4 buttons is accepted as the entry for a password. The actual number entered is unimportant, only the sequence of the button presses is required.

To start the entry of the password, press **SELECT**.

The password display is displayed on the LCD and each of the 4 buttons in sequence can now be pressed. User's password is defaulted to **HOLD** pressed 4 times. Engineer's password is defaulted to **SCROLL** pressed 4 times. Changing the user password is described later. The engineer's password cannot be changed.

This is the complete list of user and engineer menus. See appendix 4 for usage of these.

Top of users
1 View modbus Reg
2 Set Clock
3 Gas display
4 View modbus TxRx
5 Line status
6 Sensor Values
7 Lamp Test
8 Relay test
9 Event log to LCD
10 Group Setup
11 Set LED Dimmer
12 ------Exit------
13 Top of engineers
14 Alter sampletime
15 Skip + blowback
16 Alter sequence
17 Alter line text
18 Alter gas type
19 Alter blowtime
20 Adjust zero/span
21 Set alarm levels
22 Low alarm buzzer
23 Event to Relay
24 Manual Blowback
25 Cabgas source
26 Default sequence
27 Setup Network
28 Event log to PC
29 Data PC to Panel
30 Data Panel to PC
31 Clear Event log
32 Default Sections
33 Change User code
34 Set Modbus baud
35 ------Exit------
End of Engineers

SAMPLING SEQUENCE AND LINE TEXT

The sampling system can extract a gas sample from up to 48 lines and the default is that it chooses line 1 first followed by 2, 3, etc. Up to 48 and then back to 1 again.

The time of each sample can be changed in units of seconds according to line length. Critical lines can be sampled more often. To achieve this, a sequence of 144 samples is available (3 x 48 = 144)

Thus at default, this sequence is:

sequence 1-48 = sample line 1 to 48
sequence 49-96 = sample line 1 to 48
sequence 97-144 = sample line 1 to 48

Using the engineering menu, this sequence can be altered to give more samples on a specific line.

E.g. say line 3 is more likely to see a gas escape, the sequence could be altered as below.

sequence 1 = line 1
sequence 2 = line 3
sequence 3 = line 2
sequence 4 = line 3
sequence 5 = line 4
sequence 6 = line 3
sequence 7 = line 5
sequence 8 = line 3
sequence 9 = line 6
sequence 10 = line 3

In this example line 3 is sampled every alternate sample.

When altering the sequence, the option of GO-TO sequence 1 allows a short sequence to be entered without having to enter all 144 entries in the sequence table.

Each sample line has a text description which describes where it is in the system and this text is displayed on the LCD as sampling takes place.

Using engineering mode and a PC, this text can be altered from the default text.

Default text is a series of 20 full stops eg. .....

Editing this text is either manual using buttons and the LCD or by sending a text file from the PC. The latter is much faster and is preferred. Small manual changes can be made on the buttons and then this text sent to the PC and stored ready for reloading if later required.

BLOWBACK OPTIONS

When sampling gas through tubes, a small amount of debris can enter the tube and eventually cause a blockage. To counteract this, each line is capable of being blown back when a line blockage is detected or automatically after a set number of complete system cycles. In addition a manual blow back of individual lines is available.

Manual blowback is activated using engineer's menu 24. Use the arrow keys to change the line number. By using the enter key the blowback valve can be activated pressurizing the sample manifold and expelling through the selected line. Pressing scroll turns off the blowback line. This mode allows extended blowback times when clearing a major blockage.

The automatic system is always active whilst sampling is taking place and will enter a blowback sequence every 50 complete cycles of all lines.

By default, the blowback time for each line is 2 seconds but by using an engineers menu 19, this time can be modified according to the length of the sample line in use.

When automatic blowback has occurred, the system will then resample this line.

With some lines, it is vital that blowback is disabled. i.e. introduction of air (oxygen) may be a hazard to that part of the system.

Disablement of Blowback of an individual line can be achieved using engineering menu 15 "Skip + Blowback".

This allows a toggle of the blowback function.

SKIPPING A CHANNEL

Each channel is sampled according to the sequence set but it may be that a particular channel has to be skipped. E.g. maintenance.

Using engineering menu 15 "Skip + Blowback", any channel can be set to skipped or not skipped as required. When skipped the channel is not sampled indefinitely.

Whilst any channel is skipped, a LED on the front panel will illuminate to indicate this condition. To determine which line is skipped, use engineering menu 15 to inspect the skipped state.

HOLDING A CHANNEL

As the sequence of sampling occurs, it may be required to stop on a particular channel for maintenance.

This can be achieved using the **HOLD** button on the front panel which when pressed will hold the current sample for 999 seconds. A countdown is displayed on the LCD showing that hold is in progress. At the end of this time normal sampling will resume.

The 4 gas values displayed on the LCD during hold are the live readings from the sensors.

Hold can be removed at any time by pressing the hold button for a second time. If hold is removed and the original sample time is still in progress, the sample will stay on this channel until the sample time has elapsed as normal. If however the hold has been activated for longer than the sample time then the next sample in the sequence will be activated.

SCROLL TO ANOTHER CHANNEL

As the sequence of sampling continues it is sometimes required for maintenance to choose another line for sampling and this can be achieved using **SCROLL**. This button when pressed terminates the current sample time moving it to the next sample channel.

If pressed continuously, this button will step through all available sample lines and then when the desired line is reached and the button released, **HOLD** is activated for 999 seconds as if the hold button had been pressed on this channel. Pressing **SCROLL** again will continue the scrolling action to another channel.

Pressing **HOLD** will release the system back to normal sampling.

DIMMING THE LED'S

The LED's on the main processor board and on the remote LED board are normally bright but can be dimmed to give a more acceptable level of illumination in subdued control room conditions.

A push button on the main panel when pressed will toggle the brightness between maximum and dimmed for both sets of LED's.

An additional button on the remote LED board has the same function.

The level to which dimming occurs can be set via the User Menu number 11.

This shows the current brightness setting. Using the **UP** and **DOWN** buttons a new dim level can be set and this is shown on the LCD and on the LED's themselves.

This dim value is stored for future use and subsequent power ups.

In addition to dimming the LED's, the LCD backlight is also dimmed and to enable a balance between LCD brightness and led brightness, a pot on the main PCB (RV2) allows LCD backlight adjustment.

If a repeater is connected to the main panel then the dim levels are also activated using the same buttons on the repeater.

MUTE THE BUZZER

When an alarm or fault condition occurs, the buzzer on the main processor board will sound and the buzzer on the remote LED board will also be audible.

By pressing the **RESET** button on the main processor board, both buzzers will become silent. Note even if the key lock terminal is active to prevent button entry; the mute function will still silence the buzzers. An additional mute button is located on the remote LED board and this mutes the buzzer on this board only. The main buzzer is still audible until a button on the main processor board is pressed.

LOCAL AND REMOTE RELAYS

Local relays are located on the main processor board and are designated to specific conditions which exist with the sample system. Optional relays are located on one of two 32 channel relay boards and can be programmed to be operated according to the events which occur on the main processor board.

The local relays are as follows:

All relay contacts used to switch inductive loads (relays, etc) should have suppressors' fitted, typical device Farnell 772-756 (All relay contacts rated at 3A – 230v AC)

Cabinet gas – de energises if the cabinet gas measured exceeds the high alarm.
S.P.C.Oc923

Power Fail/Global Alarm (option) – will energise on any alarm and is resetable when in the alarm condition (used for audible alarm switching). Power Fail - Default setting.
S.P.C.O

Flow Fail will energise if any of the 48 sample lines has a flow fail condition.
D.P.C.O

Global Fault will energise if any fault in the system exists.
D.P.C.O

Global High will energise if any sample currently has a high alarm present.
D.P.C.O. Not resetable during alarm condition

Global Low will energise if any sample currently has a low alarm present.
D.P.C.O. Not resetable during alarm condition.

The 64 additional remote relays can be programmed to operate on an event using engineer's menu 23 "Event to Relay" so a particular event can drive any one of the 64 (S.P.C.O) relays and two separate events could drive a single relay if required. (Caution is required here, because one event may energise the relay and the other event could de-energise it).

Additionally these relays can be activated by Groups. These groups are set up in user menu 10. Each event has its own individual 16 bit pattern. This can be used to drive any of the first 16 relays in an OR'ed pattern. This means that patterns which overlap will mix together and effectively create a group. **Note:** with 48 lines, 2 alarms and 4 sensors there are a total of 384 possible 16 bit patterns. It is therefore recommended that patterns be loaded from a PC using menu 29.

GAS MEASUREMENTS

5 gasses are measured with this sampling system. Three options exist for cabgas. Normally cabgas is a flammable type and is a 4-20 mA input from and external sensor derived from the 24 volt, signal and ground connections available on the main processor board. The processor will measure this current and determine if an alarm exists so that the cabgas relay can be de-energised. The alarm levels are fixed at a high level of 30%LEL and low level 20% LEL. Calibration is assumed to have been done on the incoming 4-20 mA signal. If the cabgas input signal is removed, this is detected and a fault condition event will occur and be displayed on the LCD. As an option using users menu number 3, the cabgas can be derived from sample line 48 and sensor 1 which should be a flammable type. Clearly this method is very slow and is not preferred. The third option is to have no cabgas in use.

The signal for the four remaining gasses is derived from the 4 sensors connected to the main processor board. Depending on the sensor fitted the range of gasses are as follows:

O2	1	//Oxygen 0-25%Vol two falling alarms
CO2_30	2	//Carbon dioxide 0-30%Vol
CO2_2	3	//Carbon dioxide 0-2%Vol
H2S	4	//Hydrogen sulphide 0-50ppm
CO	5	//Carbon monoxide 0-250ppm
SO2	6	//Sulphur dioxide 0-10ppm
NO	7	//Nitrous oxide 0-100ppm
NO2	8	//Nitrogen dioxide 0-10ppm
C12	9	//Chlorine 0-10ppm
H2	10	//Hydrogen 0-2000ppm
HCN	11	//Hydrogen cyanide 0-25ppm
HCL	12	//Hydrogen chloride 0-10ppm
NH3	13	//Ammonia 0-100ppm
O3	14	//Ozone 0-2ppm
C2H4O	15	//Ethyene Oxide 0-25ppm
CH4	16	//Methane 0-1000ppm
PH3	17	//Phosphene 0-2ppm
LPG Vol	18	//Propane % volume
BUT Vol	19	//Butane % volume
FLAM Vol	20	//Flammable % volume
LPG_LEL	21	//Propane % lel
BUT_LEL	22	//Butane % lel
FLAM_LEL	23	//Flammable % lel
WATER	24	//0-100%
H2S2000	25	//Hydrogen sulphide 0-2000ppm
CH4 Vol	26	//Methane 0-100% Vol
H2S_1	27	//Hydrogen sulphide 0-1% Vol
SF6	28	SF6 transformer oil
Diesel	29	0-100%LEL diesel
Pentane	30	0-100%LEL pentane
H2S5000	31	Hydrogen sulphide 0-5000ppm
NH3500	32	Ammonia 0-500ppm
R134A	33	Refrig gas 0-1000ppm (A1=200 / A2=400)
NH31000	34	Ammonia 0-1000ppm
Hydrogen	35	hydrogen 0-100%LEL
VOC20	36	0-20ppm
VOC200	37	0-200ppm
VOC1000	38	0-1000ppm
R134A_3	39	Refrig gas 0-3000ppm
R507	40	R507 Refrig gas 0-1000ppm
CO500	41	CO 0-500ppm
CO300	42	CO 0-300ppm
R22	43	R22 0-1000ppm
R134a	44	Refrig 0-1000ppm (A1=400 / A2=800)
R1234yf	45	Refrig 0-1000ppm (A1=400 / A2=800)
CO2_100	46	Carbon Dioxide 0-100%Vol

GAS MEASUREMENTS

5 gasses are measured with this sampling system. Three options exist for cabgas. Normally cabgas is a flammable type and is a 4-20 mA input from and external sensor derived from the 24 volt, signal and ground connections available on the main processor board. The processor will measure this current and determine if an alarm exists so that the cabgas relay can be de-energised. The alarm levels are fixed at a high level of 30%LEL and low level 20% LEL. Calibration is assumed to have been done on the incoming 4-20 mA signal. If the cabgas input signal is removed, this is detected and a fault condition event will occur and be displayed on the LCD. As an option using users menu number 3, the cabgas can be derived from sample line 48 and sensor 1 which should be a flammable type. Clearly this method is very slow and is not preferred. The third option is to have no cabgas in use.

The signal for the four remaining gasses is derived from the 4 sensors connected to the main processor board.

Depending on the sensor fitted the range of gasses are as follows:

-O2	1	//Oxygen 0-25%
-CO2_1000	2	//carbon dioxide 0-1000ppm
-CO2_30	3	//Carbon dioxide 0-30%V
-CO2_2	4	//Carbon dioxide 0-2%V
-H2S	5	//Hydrogen sulphide 0-50ppm
-CO	6	//Carbon monoxide 0-250ppm
-SO2	7	//Sulpher dioxide 0-10ppm
-NO	8	//nitrous oxide 0-100ppm
-NO2	9	//Nitrogen Dioxide 0-10ppm
-Cl2	10	//Chlorine 0-10ppm
-H2	11	//Hydrogen 0-1000ppm
-HCN	12	//Hydrogen Cyanide 0-25ppm
-HCL	13	//Hydrogen Chloride 0-10ppm
-NH3	14	//Ammonia 0-100ppm
-O3	15	//Ozone 0-2ppm
-C2H4O	16	//Ethyene Oxide 0-25ppm
-CH4	17	//Methane 0-1000 ppm
-PH3	18	//Phosphene 0-2ppm
-LPG_V	19	//propane %volume
-BUT_V	20	//butane %volume
-FLAM_V	21	//flammable %volume
-LPG_LEL	22	//propane %lel
-BUT_LEL	23	//butane %lel
-FLAM_LEL	24	//flammable %lel
-WATER	25	//0-100%
-CO_1000	26	//Carbon monoxide 0-1000ppm
-NH31000	27	//Ammomnia 1000ppm
-NH35PCV	28	//Ammomnia 5%ppm
-HF	29	//Hydrogen Flouride 0-10ppm
-Temp	30	//Temp -5 to 50 deg C
-UgM3	31	//microgram per metre cubed oil mist
-B2H6	32	//Diborane 0-1ppm
-SiH4	33	//Silane 0-5ppm
-Ph3	34	//Phosphene 0-1ppm
-F2	35	//Fluorine 0-5ppm
-NF3	36	//Nitrogen Triflouride 0-50ppm
-LELM	37	//LEL per metre 0-5% full scale for 4-20mA input
-Zone	38	//used for switched inputs 0-100% scale
-refrig	39	//refrig 0-1000ppm
-benzine	40	//BENZINE 0-100%
-flame	41	//flame detector 0-100%
-fire	42	//fire detector 0-100%
-Humid	43	//Humidity 0-100%
-smoke	44	//smoke detector 0-100%
-callpoint	45	//callpoint detector 0-100%
-H2_2000	46	//hydrogen 2000ppm
-CS2	47	//Carbon DiSulphide
-H2s	48	//Hydrogen sulphide 0-100ppm
-NH35000	49	//NH3 5000ppm
-AcrylNitrile	50	
-HCl	51	//Hydrogen Chloride 0-30ppm
-Sih4	52	//Silane 0-50ppm
-NH3200	53	//amonia 0-200ppm
-VOC20	54	//0-20ppm
-VOC100	55	//0-100ppm
-VOC1000	56	//0-1000ppm
-H2LEL	57	//0-100% lel
-CO2_2000	58	//co2 0-2000ppm
-C6H14	59	//Hexane 1000ppm
-spare60	60	
-Usergas1	61	//usergas value is defined by text
-Usergas2	62	//usergas value is defined by text
-Usergas3	63	//usergas value is defined by text
-Usergas4	64	//usergas value is defined by text
-Usergas5	65	//usergas value is defined by text
-Usergas6	66	//usergas value is defined by text
-Usergas7	67	//usergas value is defined by text
-Usergas8	68	//usergas value is defined by text
-H2S3000	69	//Hydrogen sulphide 0-3000ppm
-CH4_V	70	//Methane 0-100% vol
-H2S_1	71	//Hydrogen sulphide 0-1%
-SF6	72	//SF6 transformer oil
-Diesel	73	//0-100%LEL diesel
-Pentane	74	//0-100%LEL pentane
-H2S5000	75	//Hydrogen sulphide 0-5000ppm
-NH3500	76	//Amonia 0-500ppm
-R134A	77	// Refrig gas 0-1000ppm
-NH31000	78	//Amonia 0-1000ppm
-R134A_3	79	// Refrig gas 0-3000ppm

MODBUS SET UP AND INDICATORS

Modbus is a means of obtaining data from the gas sampling system via a MODBUS master controller. The gas sample system is a SLAVE to the commands received from the master via two RS485 twisted pair communication cables. When a command is received on one of these cables, the reply is sent on the same cable thus giving rise to half-duplex communication.

For maintenance purposes, two LED's situated on the main processor PCB show when a reply is being sent on that particular cable. A modbus system using both cables should show communications are in progress by the periodic flashing of these LED's. Once the communication has started, the sample system will monitor how long since the last command was received and if this is greater than 50 seconds, a comms fail alarm will occur. This can be deactivated by toggling the modbus time out function to OFF.

Each sampling system has an internal address, which is used both for Modbus address and CAN bus address (see repeaters). This address and other parameters can be set and will be remembered at power up using engineer's menu 27 "Setup Network". The speed of communication (baud rate, bits per second) is set using engineering menu 34. All communicating devices in a modbus system should be set to the same baud rate and the gas sampling system is capable of supporting 19200, 9600 and 4800 baud. 9600 is the default setting.

Operating Parameters

Baud Rate 960

No Parity

1 Stop Bit

Time delay between your Modbus transmission (delay between polls) should be 250ms or greater. The maximum number of register you can request in one go is 10.

The protocol for the data packets received from a master is usually a request for specific data to be sent back to the master. This protocol is covered in a separate document. In its simple form, the master will ask for the data kept in any of the 250 registers located in the gas sample system. These registers are 16 bit numbers representing - 0 to 65535 in decimal.

See Modbus Register Specification in appendix 3 for full description.

RS232 DATA LOG OUTPUT

In addition to Modbus, an additional data stream showing actions within the sample system is available via the RS232 output.

This consists of a 3 wire interface which can connect directly into the Com1/2 RS232 connection on a PC which is a 9 way D-type female connector (not supplied)

This should be wired to the gas sampling system as follows.

D type Pin	Gas sample RS232 connector (Top centre of PCB)
2	Tx
3	Rx
5	0V

Using hyper-terminal on the PC and set up at 1200 baud 8 bit no parity and no handshake, the data output should appear on the screen and consists of the following.

1) Time and date is sent every hour
2) Event information is sent e.g. alarms faults and resets

EVENT LOG

The events listed in appendix 1 are logged internally in the gas sample system.

A total of 99 events can be stored and viewed later either on the display or on a PC using Hyper-terminal.

Note: When this 99 event memory is full, the oldest event is replaced by the new event so this history of events always represents the last 99 incidents.

Using engineer's/user menu number 9, this event memory can be viewed one event at a time using the arrow buttons to scroll through the sequence. Date and time of the event is also displayed.

With the RS232 cable connected to the PC and Hyper-terminal in use at 1200 baud, the whole event log can be sent using engineering menu 28.

Using "capture text" in Hyper-terminal, this event log can be saved to a file for future examination or printing, etc.

Data to and from a PC using hyper-terminal

Within the gas sampling system there are parameters which have to be set such as the sequence or text which describes a particular sample line. Whilst these parameters can be set manually using the buttons, it is quicker and easier to send a text data file from a PC using the RS232 interface via Hyper-terminal (which is standard on your PC).

The file which is sent is simple alphabetic characters which can be edited using a simple text editor like Notepad which is also standard on your PC.

This file can be created from scratch but it is simpler to create it by sending the data already stored on the gas sampling panel to the PC again using Hyper-terminal. This method is now described followed by reloading the file back into the gas sampling panel.

Using engineering menu 30 (Data panel to PC) and the RS232 lead plugged into the PC Com port 1 (say).

On the PC, (for Windows XP)

START
PROGRAMS
ACCESSORIES
COMMUNICATIONS
HYPERTERMINAL

Set the hyper-terminal to COM1 at 8 data bits no parity 1 stop bit no handshake then using Transfer and Capture text, a filename is suggested to save the data to. You can change this filename as required and do take note of which directory it is going to be stored in, then press the start button and the PC is now waiting for data to be sent from the sampling system.

On the sampling system, using engineering menu 30 (Data panel to PC) now press select which should send data to the PC. This data can be seen on the PC screen as it is transferred. When it is complete, use Transfer and Capture text and STOP to write the file to disk.

Each line of text *(shown in italics)* in this file forms particular data as follows:

A line which does not start with a colon: is ignored which allows you to add comments at any point in the text.

Data to PC from panel address 2	is a comment
:T6, Port Hold 1	This line is the text for sample line 6 which will display on the LCD when sample line 6 is about to be sampled. 48 texts for each line, 20 characters each can be entered
:G1 ,%LeL^ ,	This line selects a gas type for gas sensor 1 The appropriate gas sensor must be fitted in the system. 4 gas types can be selected
:HiAlarm 2,400	The high alarm point for gas 2 is 400 divided by 10 4 high alarms can be set according to the type of gas and the value represents 10 times the actual value. (this is to avoid decimal points in the data)
:LoAlarm 1,200	Ditto for gas 1 low alarm point.
:OrAlarm 3,998	Ditto for gas 3 over range alarm
:Maxval 4,999	The maximum scale value for gas 4 is 999 divided by 10
:S1,1	The sample sequence number 1 is line 1

:S2,2	The sample sequence number 2 is line 2
:S3,1	The sample sequence number 3 is line 1 again
:S144,48	The sample sequence number 144 is line 48 This sequence versus sample line can be entered in any order. But take care not to duplicate because later S lines could override earlier ones.
L2 G A gfedcba987654321 gfedcba987654321	represents the 16 relays (1 = Relay 1 and g = Relay 16)
:P2 3 1 0000000000100001	This pattern means line 2, gas 3, alarm 1 activates relays 1 and 6

:X	This terminates the text transmission to the panel and should always be at the end of the text. If this appears before the end, the text lines after X are ignored.
	If an X is not included in the file, the panel eventually times out but this may take a few minutes.

Having edited the text to suit the installation, it can now be sent back to the panel using engineers menu 29 "PC to panel" Again, Hyper-terminal is used but this time the Transfer/send text file option is used.

When prompted, choose your modified text file as the one to send and then the text should start to flow. The output seen on the Hyper-terminal screen consists of the command letters received so strings of "T " or "S", etc. Which lets you know that all is well. The final letter seen will be an "X" and at this point the new data sent is stored in non-volatile memory on the processor board.

FLOW FAIL AND PUMP FAIL

The pressure of the pump(s) in the sample system are monitored and a loss of pressure is detected and gives rise to a pump1 or pump2 fault which is logged into the 99 event memory and will activate the Global fault relay. Pump failure can occur from loss of power or from a worn out diaphragm. Preventative maintenance should ensure that this event is rare. During sampling time for any line, the vacuum level is monitored and if it is too high then the line is deemed to be blocked which is called Flow Fail and it is logged into the 99 event memory.

An LED on the front panel will illuminate and a flow fail relay will activate as well as the global fault relay on the main processor board.

REAL TIME CLOCK

On the main processor board a real time clock chip keeps time and this can be set using user/engineer's menu 2. To ensure that the clock keeps time when no power is applied, a large value capacitor on the PCB provides power to the clock for up to 24 hours.

If the processor board is not powered for longer than this, it is possible that the clock will have to be reset to local time before use.

It is important to keep the clock correct as this time is used when recording events in the event log and also for the RS232 output log to a PC.

CHANGING USER PASSWORD

The passwords are present to prevent unauthorised button entry on the sample system and whilst the engineer's password is fixed, the user password can be changed. Using engineers menu 33 will allow you to enter a new user password.

You are prompted to re-enter the password again to check and if both are the same then this password is the new user password. If this password has been forgotten, then simply change it to a new known password.

CALIBRATING THE GAS SENSORS

Each of the 4 direct 4-20mA gas sensors has to be periodically calibrated and to assist in this process; engineer menu 20 "adjust zero/span" will guide you through the stages of calibration. Potentiometers on the sensor CV transmitters themselves are adjusted to calibrate and the values are seen on the LCD.

Note: CAN sensors cannot be calibrated from the panel and must be done individually at the sensor itself.

Using **UP** and **DOWN** buttons and **SELECT**.

The first step is to select which of the 4 gasses is to be calibrated.

Pressing **SELECT** moves to the next step which is, set the maximum value expected from the sensor e.g. flam is 99.9%

Pressing **SELECT** moves to the next step which is, adjust the zero pot on the card until the reading is zero on the LCD.

Pressing **SELECT** moves to the next step which is applying span gas and adjusting the gain pot on the card until the reading is correct on the LCD.

This completes the calibration of one of the gas card / sensor combination.

SETTING ALARM LEVELS

The first option displayed is whether or not the low alarm is latching or unlatching. Toggle this option with the **ENTER** button. This is followed by the same option for the high alarms. Typically low alarms are set to unlatching and high alarms are latching.

The high and low alarm points for the 4 gas cards can be set manually using engineering menu 21 "Set alarm levels".

The LCD requests that you set the alarm using up and down buttons for gas 1,

Use **SCROLL** and **ENTER** to select any of the 4 gasses which requires change.

Press **SELECT** which request your setting of High alarm point. Again the gas number can be changed using scroll and enter. This allows all low alarm for each gas and then all high alarms to be set.

Pressing **SELECT** again allows the over range alarm or each gas to be set.

Pressing **SELECT** again will exit the menu and save the parameters to memory.

Also using menu 22, the buzzer can be disabled on low alarms. When used in conjunction with unlatched low alarms, nuisance buzzer activity on marginal gas levels can be eliminated.

VALVE DETECTION AND FAULT

At power up the 48 way solenoid board that opens and closes the sample lines to the vacuum pump is checked by the main processor board to determine which valves are connected, e.g. a 24 line sample system will have 24 of the valves missing. These missing valves are noted and the sequence of samples taken will automatically miss out these solenoids. This is different from Skip which is a deliberate decision not to use a solenoid that is fitted (see skip). With known valves in the system, any subsequent open circuit fault on a valve (e.g. coil failed) will be detected and a valve fail alarm event will occur. The sample system does not know what kind of fault is present, only that something is not working properly on the solenoid and that it should be investigated.

DEFAULTING SECTIONS OF THE PANEL

Using engineer's menu 32, individual parameters can be defaulted. These are: Event log, Modbus/Canbus, Gas type, Line text, Event to relay, Sample/blowback time.

DEFAULT THE WHOLE PANEL FROM POWER UP

At manufacture of a new processor board and possibly in service if a new setup is to be installed, it is convenient to clear all system parameters and load default settings.

This can be done by pressing and releasing the processor reset button on the PCB at the same time that the **SELECT** button is pressed and held down. Release the **SELECT** button when the LCD displays the default message.

Clearly, this is only to be done if you are sure that a complete default is required. Always ensure that a copy of the old set up is available in a text file which can be reloaded if needed.

REPEATER

The main panel with its gas cards and drivers etc is usually situated near to the pumps solenoids and sensors but it may be required to have a duplicate console elsewhere such as the bridge or control room where pump noise is unacceptable.

Using a CAN network, and a 24 volt supply, a repeater can be connected which gives a user interface identical to the main panel. The data displayed on the LCD, LED's and on the LED board comes from the main panel.

Likewise, button pushes on the repeater are transmitted to the main panel and are used by the main panel as if they had been pressed locally.

To ensure operation of the repeater, it has to be set up to accept CAN data from a main panel and know where to send its own CAN data.

From power up or by pressing the processor reset button on the repeater and pressing the **SELECT** button at the same time the following sequence will occur on the LCD after releasing the **SELECT** button.

Set this address, use **UP** and **DOWN** buttons to choose a free address that the repeater will use at its own address. Press **ENTER.**

Set From address, this is the main panel address which will send LCD and LED data out and this repeater will display it.

Press **ENTER** and these two addresses will be stored.

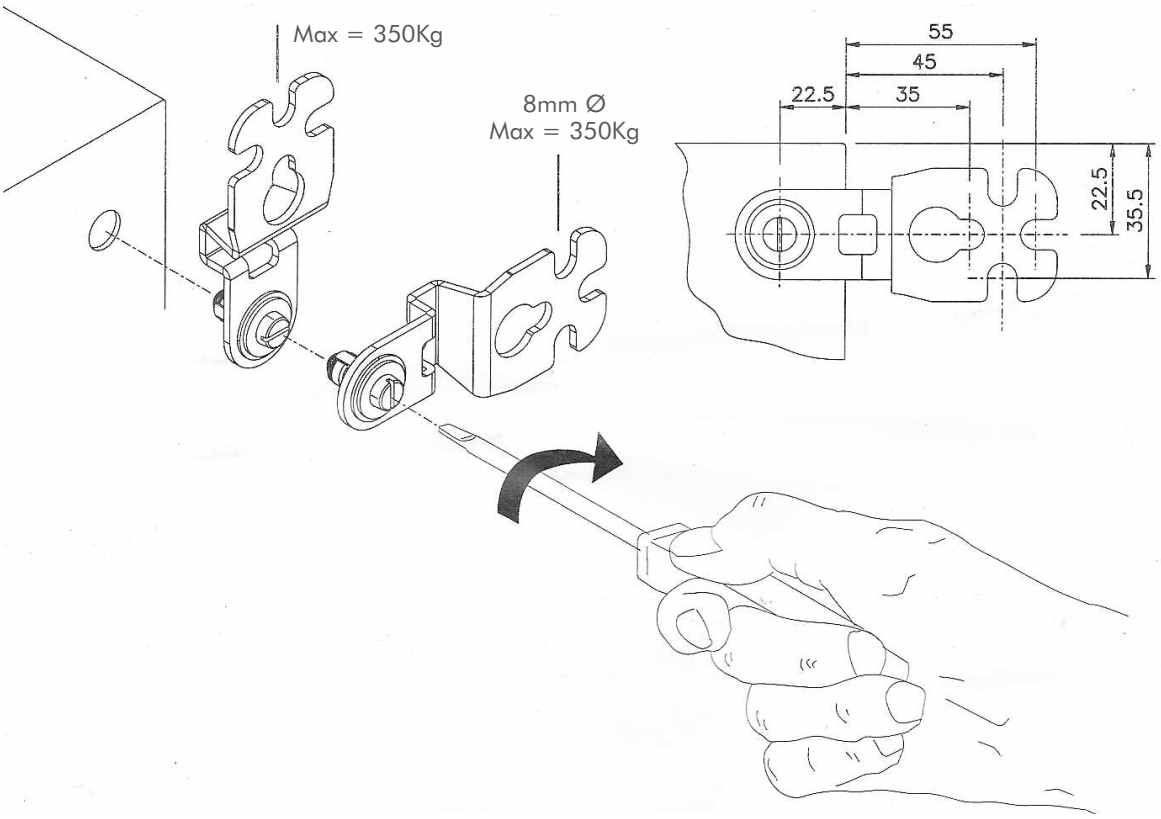
INSTALLATION AND SETTING UP

The enclosure should be securely mounted to a substantial wall at chest height using the brackets provided. Its position should be such as to provide a clear field of vision of any alarm indications.

To position the enclosure a supporting trestle of the required height should be positioned to enable two men to lift the enclosure on to the trestle following which the enclosure mounting brackets should be located and attached to the enclosure and wall by either large screws or expansion bolts. Equipment weight – 65kg – standard system.

A 3A fused mains supply should be provided and terminated at the mains isolators within the enclosure.

Having connected the vent and sample lines and where provided air-line pressure regulator. (**Note:** the vent port is 10mm OD no reduction in this size should be made, where two vents are provided no reduction in overall vent size should occur, maximum flow should be allowed to prevent possible back pressure affecting the sensor reading). Switch on the power. (If the system is fitted with cabinet internal leak detector [auto shutdown device] the system has to be manually started by pressing the push switch located on the internal power supply unit).



SERVICE – ROUTINE ATTENTION

The owner or occupier of the site should place the supervision of the system in the charge of a responsible executive, whose duty it should be to ensure the day to day operation of the system and to lay down the procedure for dealing with a gas alarm or fault warning.

The operating instructions should be kept available preferably with the control unit. All faults, services, tests and routine attention given should be recorded.

DAILY: A check should be made that any fault condition may be indicated and is being attended to and that all other indicators are normal.

WEEKLY: Check the catch pot for high levels of particulate or water contamination. On sites involving a high risk process or having gases which may cause loss of sensitivity a check on calibration should be carried out.

SIX MONTHLY MAINTENANCE

1. Zero check to gas sensor
2. Sensor to be gas tested and readings logged (sensitivity checked).
3. Field indicators to be tested.
4. Alarm trip points checked and re-aligned.
5. All faulty parts replaced where required.
6. All filter elements checked and replaced as necessary.
7. Power supply – voltage check.
8. Visual inspection made to confirm that all sample line fittings and equipment are secure, undamaged and adequately protected.

12 MONTHLY MAINTENANCE SCHEDULE

1. Six monthly check.
2. Pump overhaul (diaphragm replacement).

Replacement Parts

008-350	Draw pump 230v AC 50/60hz
008-352	Draw pump 115v AC 50/60Hz
008-351	Pump service kit

APPENDIX 1

Event numbers are as follows

pumpfail_1	0
pumpfail_2	1
gas_sensor_1_fail	2
gas_sensor_2_fail	3
gas_sensor_3_fail	4
gas_sensor_4_fail	5
cabgas_sensor_fail	6
Gas_1_high_alarm	7
Gas_2_high_alarm	8
Gas_3_high_alarm	9
Gas_4_high_alarm	10
Gas_1_low_alarm	11
Gas_2_low_alarm	12
Gas_3_low_alarm	13
Gas_4_low_alarm	14
Flow_fail_alarm	15
comm_fail_alarm	16
main_power_alarm	17
standby_power_alarm	18
cabgas_high_alarm	19
valve_fail_alarm	20
cab_gas_lost_alarm	21
sensor_1_fault_alarm	22
sensor_2_fault_alarm	22
sensor_3_fault_alarm	22
sensor_4_fault_alarm	22
panelreset	23
clear_event_log	24
can_bus_alarm	25
flowfail_2	26
CANGas_1_lo_alarm	28
CANGas_2_lo_alarm	29
CANGas_3_lo_alarm	30
CANGas_4_lo_alarm	31
CANGas_5_lo_alarm	32
CANGas_6_lo_alarm	33
CANGas_7_lo_alarm	34
CANGas_8_lo_alarm	35
CANGas_1_hi_alarm	36
CANGas_2_hi_alarm	37
CANGas_3_hi_alarm	38
CANGas_4_hi_alarm	39
CANGas_5_hi_alarm	40
CANGas_6_hi_alarm	41
CANGas_7_hi_alarm	42
CANGas_8_hi_alarm	43

APPENDIX 2

Typical text file which can be sent to the sampling system

Data to PC from panel address 2
:T1, Line 1 text
:T2, Line 2 text
:T3, Line 3 text
:T4, Line 4 text
:T5, Line 5 text
:T6, Line 6 text
:T7, Line 7 text
:T8, Line 8 text
:T9, Line 9 text
:T10, Line 10 text
:T11, Line 11 text
:T12, Line 12 text
:T13, Line 13 text
:T14, Line 14 text
:T15, Line 15 text
:T16, Line 16 text
:T17, Line 17 text
:T18, Line 18 text
:T19, Line 19 text
:T20, Line 20 text
:T21, Line 21 text
:T22, Line 22 text
:T23, Line 23 text
:T24, Line 24 text
:T25, Line 25 text
:T26, Line 26 text
:T27, Line 27 text
:T28, Line 28 text
:T29, Line 29 text
:T30, Line 30 text
:T31, Line 31 text
:T32, Line 32 text
:T33, Line 33 text
:T34, Line 34 text
:T35, Line 35 text
:T36, Line 36 text
:T37, Line 37 text
:T38, Line 38 text
:T39, Line 39 text
:T40, Line 40 text
:T41, Line 41 text
:T42, Line 42 text
:T43, Line 43 text
:T44, Line 44 text
:T45, Line 45 text

```
:T46, Line 46 text
:T47, Line 47 text
:T48, Line 48 text

:G1, %LeL^ ,
:G2, %LeL^ ,
:G3, %LeL^ ,
:G4, %LeL^ ,

:HiAlarm 1, 400
:HiAlarm 2, 400
:HiAlarm 3, 400
:HiAlarm 4, 400

:LoAlarm 1, 200
:LoAlarm 2, 200
:LoAlarm 3, 200
:LoAlarm 4, 200
:OrAlarm 1, 998
:OrAlarm 2, 998
:OrAlarm 3, 998
:OrAlarm 4, 998
:Maxval 1, 999
:Maxval 2, 999
:Maxval 3, 999
:Maxval 4, 999

:S1,1:S2,2:S3,3:S4,4:S5,5:S6,6:S7,7:S8,8:S9,9:S10,10:S11,11:S12,12:S13,13:S14,14:S1
5,15:S16,16:S17,17:S18,18:S19,19:S20,20:S21,21:S22,22:S23,23:S24,24:S25,25
:S26,26:S27,27:S28,28:S29,29:S30,30:S31,31:S32,32:S33,33:S34,34:S35,35:S36,36
:S37,37:S38,38:S39,39:S40,40:S41,41:S42,42:S43,43:S44,44:S45,45:S46,46:S47,47
:S48,48:S49,1:S50,2:S51,3:S52,4:S53,5:S54,6:S55,7:S56,8:S57,9:S58,10:S59,11
:S60,12:S61,13:S62,14:S63,15:S64,16:S65,17:S66,18:S67,19:S68,20:S69,21:S70,22
:S71,23:S72,24:S73,25:S74,26:S75,27:S76,28:S77,29:S78,30:S79,31:S80,32:S81,33
:S82,34:S83,35:S84,36:S85,37:S86,38:S87,39:S88,40:S89,41:S90,42:S91,43:S92,44
:S93,45:S94,46:S95,47:S96,48:S97,1:S98,2:S99,3:S100,4:S101,5:S102,6:S103,7
:S104,8:S105,9:S106,10:S107,11:S108,12:S109,13:S110,14:S111,15:S112,16
:S113,17:S114,18:S115,19:S116,20:S117,21:S118,22:S119,23:S120,24:S121,25
:S122,26:S123,27:S124,28:S125,29:S126,30:S127,31:S128,32:S129,33:S130,34
:S131,35:S132,36:S133,37:S134,38:S135,39:S136,40:S137,41:S138,42:S139,43
:S140,44:S141,45:S142,46:S143,47:S144,48
:X
```

APPENDIX 3
MODBUS REGISTER SPECIFICATION (without CAN sensors)

APPENDIX 3 Modbus Register Specification (without CAN sensors) Function code 03 used throughout to access these 16 bit unsigned registers. Function code 8 is used to poll this modbus address, all other function code requests will respond with illegal function (01). Register address requests >250 will respond with illegal address (02). The maximum number of registers that can be requested in one transmission is 20, requesting more than this will cause an illegal address response, and time delay between your Modbus transmission (delay between polls should be 250ms or greater).

Baud rate 4800,9600,19200 No parity 1 stop bits 2 channel known as Duty and standby (RS485)

Register	Sample Line locations	Data	Units
0	WATCHDOG	incrementing 250 USEC counter	0- 65535
1 to 48	1 to 48	Gas sensor 1	0-100%LEL
49 to 96	1 to 48	Gas sensor 2	0-100%LEL
97 to 147	1 to 48	Gas sensor 3	0-100%LEL
148 to 197	1 to 48	Gas sensor 4	0-100%LEL
198	1 to 16	Sensor 1 Low alarm	1=alarm (bit 0 is sample line 1 etc)
199	17 to 32	Sensor 1 Low alarm	1=alarm (bit 0 is sample line 17 etc)
200	33 to 48	Sensor 1 Low alarm	1=alarm (bit 0 is sample line 33 etc)
201	1 to 16	Sensor 1 High alarm	1=alarm (bit 0 is sample line 1 etc)
202	17 to 32	Sensor 1 High alarm	1=alarm (bit 0 is sample line 17 etc)
203	33 to 48	Sensor 1 High alarm	1=alarm (bit 0 is sample line 33 etc)
204	1 to 16	Sensor 2 Low alarm	1=alarm (bit 0 is sample line 1 etc)
205	17 to 32	Sensor 2 Low alarm	1=alarm (bit 0 is sample line 17 etc)
206	33 to 48	Sensor 2 Low alarm	1=alarm (bit 0 is sample line 33 etc)
207	1 to 16	Sensor 2 High alarm	1=alarm (bit 0 is sample line 1 etc)
208	17 to 32	Sensor 2 High alarm	1=alarm (bit 0 is sample line 17 etc)
209	33 to 48	Sensor 2 High alarm	1=alarm (bit 0 is sample line 33 etc)
210	1 to 16	Sensor 3 Low alarm	1=alarm (bit 0 is sample line 1 etc)
211	17 to 32	Sensor 3 Low alarm	1=alarm (bit 0 is sample line 17 etc)
212	33 to 48	Sensor 3 Low alarm	1=alarm (bit 0 is sample line 33 etc)
213	1 to 16	Sensor 3 High alarm	1=alarm (bit 0 is sample line 1 etc)
214	17 to 32	Sensor 3 High alarm	1=alarm (bit 0 is sample line 17 etc)
215	33 to 48	Sensor 3 High alarm	1=alarm (bit 0 is sample line 33 etc)
216	1 to 16	Sensor 4 Low alarm	1=alarm (bit 0 is sample line 1 etc)
217	17 to 32	Sensor 4 Low alarm	1=alarm (bit 0 is sample line 17 etc)
218	33 to 48	Sensor 4 Low alarm	1=alarm (bit 0 is sample line 33 etc)
219	1 to 16	Sensor 4 High alarm	1=alarm (bit 0 is sample line 1 etc)
220	17 to 32	Sensor 4 High alarm	1=alarm (bit 0 is sample line 17 etc)
221	33 to 48	Sensor 4 High alarm	1=alarm (bit 0 is sample line 33 etc)
222	system status	bit 0 = global sensor fail	
		bit 1 = global flow fail	
		bit 2 = system fault	
		bit 3 = standby power lost	
		bit 4 = main power lost	
		bit 5 = global valve fail	
		bit 6 = pump 1 fail	
		bit 7 = pump 2 fail	
		bit 8 = modbus comms fail	
		bit 9 = cab gas fail	
		bit 10 = Can bus fail	
		bit 11 = spare	
		bit 12 = spare	
		bit 13 = spare	
		bit 14 = spare	
		bit 15 = spare	
223	Sensor fail	bit 0 is sensor 1	1=fail
		bit 1 is sensor 2	1=fail
		bit 2 is sensor 3	1=fail
		bit 3 is sensor 4	1=fail
	Sample Line locations		
224	1 to 16	Flow fail	1=fail (bit 0 is sample line 1 etc)
225	17 to 32	Flow fail	1=fail (bit 0 is sample line 17 etc)
226	33 to 48	Flow fail	1=fail (bit 0 is sample line 33 etc)
227	1 to 16	Valve fail	1=fail (bit 0 is sample line 1 etc)
228	17 to 32	Valve fail	1=fail (bit 0 is sample line 17 etc)
229	33 to 48	Valve fail	1=fail (bit 0 is sample line 33 etc)
230	All	Line being sampled	INTEGER 0 - 48

APPENDIX 3
MODBUS REGISTER SPECIFICATION (with CAN sensors)

APPENDIX 3 Modbus Register Specification (with CAN sensors) Function code 03 used throughout to access these 16 bit unsigned registers. Function code 8 is used to poll this modbus address, all other function code requests will respond with illegal function (01). Register address requests >250 will respond with illegal address (02). The maximum number of registers that can be requested in one transmission is 20, requesting more than this will cause an illegal address response, and time delay between your Modbus transmission (delay between polls should be 250ms or greater).

Baud rate 4800,9600,19200, No parity, 1 stop bits, 2 channel known as Duty and standby (RS485)

The following chart shows the Modbus registers and what they represent.

modbus registers		GasVac 305 CAN	all registers 16 bit integer
Start Reg	**Line**	**Data**	**Units**
0	0	watchdog	0-65535
1	1 to 48	gas sensor 4-20mA 1	eg LEL
49	1 to 48	gas sensor 4-20mA 2	eg LEL
97	1 to 48	gas sensor 4-20mA 3	eg LEL
145	1 to 48	gas sensor 4-20mA 4	eg LEL
193	1 to 48	gas sensor CAN address 1	eg LEL
241	1 to 48	gas sensor CAN address 2	eg LEL
289	1 to 48	gas sensor CAN address 3	eg LEL
337	1 to 48	gas sensor CAN address 4	eg LEL
385	1 to 48	gas sensor CAN address 5	eg LEL
433	1 to 48	gas sensor CAN address 6	eg LEL
481	1 to 48	gas sensor CAN address 7	eg LEL
529	1 to 48	gas sensor CAN address 8	eg LEL
530	1 to 16	gas sensor 4-20mA 1 Lo Alarm	16 bit , 1-alrm ,bit0=line1
531	17 to 32	gas sensor 4-20mA 1 Lo Alarm	16 bit , 1-alrm ,bit0=line17
532	33 to 48	gas sensor 4-20mA 1 Lo Alarm	16 bit , 1-alrm ,bit0=line33
533	1 to 16	gas sensor 4-20mA 2 Lo Alarm	16 bit , 1-alrm ,bit0=line1
534	17 to 32	gas sensor 4-20mA 2 Lo Alarm	16 bit , 1-alrm ,bit0=line17
535	33 to 48	gas sensor 4-20mA 2 Lo Alarm	16 bit , 1-alrm ,bit0=line33
536	1 to 16	gas sensor 4-20mA 3 Lo Alarm	16 bit , 1-alrm ,bit0=line1
537	17 to 32	gas sensor 4-20mA 3 Lo Alarm	16 bit , 1-alrm ,bit0=line17
538	33 to 48	gas sensor 4-20mA 3 Lo Alarm	16 bit , 1-alrm ,bit0=line33
539	1 to 16	gas sensor 4-20mA 4 Lo Alarm	16 bit , 1-alrm ,bit0=line1
540	17 to 32	gas sensor 4-20mA 4 Lo Alarm	16 bit , 1-alrm ,bit0=line17
541	33 to 48	gas sensor 4-20mA 4 Lo Alarm	16 bit , 1-alrm ,bit0=line33
542	1 to 16	gas sensor CAN address 1 Lo Alarm	16 bit , 1-alrm ,bit0=line1
543	17 to 32	gas sensor CAN address 1 Lo Alarm	16 bit , 1-alrm ,bit0=line17
544	33 to 48	gas sensor CAN address 1 Lo Alarm	16 bit , 1-alrm ,bit0=line33
545	1 to 16	gas sensor CAN address 2 Lo Alarm	16 bit , 1-alrm ,bit0=line1
546	17 to 32	gas sensor CAN address 2 Lo Alarm	16 bit , 1-alrm ,bit0=line17
547	33 to 48	gas sensor CAN address 2 Lo Alarm	16 bit , 1-alrm ,bit0=line33
548	1 to 16	gas sensor CAN address 3 Lo Alarm	16 bit , 1-alrm ,bit0=line1
549	17 to 32	gas sensor CAN address 3 Lo Alarm	16 bit , 1-alrm ,bit0=line17
550	33 to 48	gas sensor CAN address 3 Lo Alarm	16 bit , 1-alrm ,bit0=line33
551	1 to 16	gas sensor CAN address 4 Lo Alarm	16 bit , 1-alrm ,bit0=line1
552	17 to 32	gas sensor CAN address 4 Lo Alarm	16 bit , 1-alrm ,bit0=line17
553	33 to 48	gas sensor CAN address 4 Lo Alarm	16 bit , 1-alrm ,bit0=line33
554	1 to 16	gas sensor CAN address 5 Lo Alarm	16 bit , 1-alrm ,bit0=line1
555	17 to 32	gas sensor CAN address 5 Lo Alarm	16 bit , 1-alrm ,bit0=line17
556	33 to 48	gas sensor CAN address 5 Lo Alarm	16 bit , 1-alrm ,bit0=line33
557	1 to 16	gas sensor CAN address 6 Lo Alarm	16 bit , 1-alrm ,bit0=line1
558	17 to 32	gas sensor CAN address 6 Lo Alarm	16 bit , 1-alrm ,bit0=line17
559	33 to 48	gas sensor CAN address 6 Lo Alarm	16 bit , 1-alrm ,bit0=line33
560	1 to 16	gas sensor CAN address 7 Lo Alarm	16 bit , 1-alrm ,bit0=line1
561	17 to 32	gas sensor CAN address 7 Lo Alarm	16 bit , 1-alrm ,bit0=line17
562	33 to 48	gas sensor CAN address 7 Lo Alarm	16 bit , 1-alrm ,bit0=line33
563	1 to 16	gas sensor CAN address 8 Lo Alarm	16 bit , 1-alrm ,bit0=line1
564	17 to 32	gas sensor CAN address 8 Lo Alarm	16 bit , 1-alrm ,bit0=line17
565	33 to 48	gas sensor CAN address 8 Lo Alarm	16 bit , 1-alrm ,bit0=line33
566	1 to 16	gas sensor 4-20mA 1 Hi Alarm	16 bit , 1-alrm ,bit0=line1
567	17 to 32	gas sensor 4-20mA 1 Hi Alarm	16 bit , 1-alrm ,bit0=line17
568	33 to 48	gas sensor 4-20mA 1 Hi Alarm	16 bit , 1-alrm ,bit0=line33
569	1 to 16	gas sensor 4-20mA 2 Hi Alarm	16 bit , 1-alrm ,bit0=line1
570	17 to 32	gas sensor 4-20mA 2 Hi Alarm	16 bit , 1-alrm ,bit0=line17
571	33 to 48	gas sensor 4-20mA 2 Hi Alarm	16 bit , 1-alrm ,bit0=line33
572	1 to 16	gas sensor 4-20mA 3 Hi Alarm	16 bit , 1-alrm ,bit0=line1
573	17 to 32	gas sensor 4-20mA 3 Hi Alarm	16 bit , 1-alrm ,bit0=line17
574	33 to 48	gas sensor 4-20mA 3 Hi Alarm	16 bit , 1-alrm ,bit0=line33
575	1 to 16	gas sensor 4-20mA 4 Hi Alarm	16 bit , 1-alrm ,bit0=line1
576	17 to 32	gas sensor 4-20mA 4 Hi Alarm	16 bit , 1-alrm ,bit0=line17
577	33 to 48	gas sensor 4-20mA 4 Hi Alarm	16 bit , 1-alrm ,bit0=line33
578	1 to 16	gas sensor CAN address 1 Hi Alarm	16 bit , 1-alrm ,bit0=line1
579	17 to 32	gas sensor CAN address 1 Hi Alarm	16 bit , 1-alrm ,bit0=line17
580	33 to 48	gas sensor CAN address 1 Hi Alarm	16 bit , 1-alrm ,bit0=line33
581	1 to 16	gas sensor CAN address 2 Hi Alarm	16 bit , 1-alrm ,bit0=line1
582	17 to 32	gas sensor CAN address 2 Hi Alarm	16 bit , 1-alrm ,bit0=line17

Gas Display

Use the **UP** and **DOWN** buttons to choose how many of the four gasses are to be displayed on the LCD display. This allows systems with less than four gasses to remove unconnected gas sensors from the LCD. When **SELECT I**s pressed, the option to indicate sensor faults is presented. **UP** and **DOWN** buttons toggle this. When **SELECT** is pressed again the option to use the **POWER FAIL RELAY** as a sounder is presented. **UP** and **DOWN** buttons toggle this. When sounder is chosen, it is muted when reset is pressed and comes on with any new alarm.

View Modbus TXRX

As a diagnostic tool for modbus communications, this display shows the data packets received from a modbus master (RX) and the reply sent back from the GasVac 305 (TX).
This display is in Hexadecimal and to understand the meaning, the modbus data packet protocol has to be analysed. It is generally used when first getting the modbus system running.
Press **SELECT** to exit this menu.

Line Status

Again, this display is used for diagnostics of each of the sample lines.
The top line of the display shows the LINE status in Hexadecimal
Bit 0 = Valve connected
Bit 1 = Valve fault
Bit 2 = Low alarm
Bit 3 = High alarm
Bit 4 = Overange alarm
Bit 5 = Flowfail
Bit 6 = Skipped
Bit 7 = Blowback allowed
Typical display may read
Line = 1 status 81
Here bit 0 is set indicating valve present and bit 7 is set showing that blowback is allowed.

A Sample line may be inhibited for a number of complete cycles of the sample sequence and this number is shown on the LCD as Inhibitcounter.
The total number of valves present is also displayed. Use **SELECT** to exit.

Sensor Values

Each of the four Direct 4-20mA gasses is displayed as a live reading. Use **SELECT** to exit.

Lamp Test

This menu will illuminate all front panel LED's on the main PCB and those on the remote LED board when connected.
When complete, the PCB buzzer will sound and the menu exits.
Note that the LED test is done with DIM active to save excessive current from the PSU.

Relay Test

A 64 Relay card can be fitted to the GasVac 305 (2 x 32) and in order to test it and any wiring to the contacts, this menu can be used.
UP and **DOWN** chooses which of the 64 relays to test and the **ENTER** button will energise it.
The **SCROLL** button will de-energise the relay. The state of the relay can be seen via individual LED's on this board.

SELECT will exit the menu.

Event Log to LCD

The internal 99 event log can be viewed on the LCD display one event at a time.
Each line of the display indicates the following
Line 1 shows the type of event with the time of occurrence.

Types are	FLT	is a fault such as sensor 1 fail
	Hi Alrm	is high alarm
	Lo Alrm	is low alarm
	SYS	is a system event such as a panel reset

Line 2 and 3 show text relating to the event.
Line 4 shows which event is being displayed and how many events are logged.
Eg 3 of 76 events means that the display is showing event 3 and 76 events are logged.
76 is the oldest event and 1 is the latest event.
Use **UP** and **DOWN** to choose which event to view.
SELECT will exit the menu.

Group Setup

Each of the 48 sample lines can belong to one of eight groups. Each group has two relays associated with it, and one of these relays is mutable. This menu allows you to set the group and which relays are to be used in that group.

UP and **DOWN** chooses the sample line,
RESET alters the **GROUP**
SCROLL alters the Mutable relay
ENTER alters the Non-mutable relay
SELECT will exit the menu.
Note: that relay 0 is a none existent relay and is chosen when a group does not energise a relay which is the default condition.

Set LED Dimmer

The value of brightness for the LED when dimmed is set using **UP** and **DOWN** buttons and **SELECT** will exit the menu.
The actual brightness is displayed on the LCD as a percentage and on the front panel LED's themselves whilst adjusting.
This level of brightness will be used in normal mode when the **DIM** button is pressed.

Alter Sample Time

Each sample line samples the gas for a given time in seconds and this can be altered using **ENTER** to increase and **SCROLL** to decrease the time. **UP** and **DOWN** change the sample line being adjusted and **SELECT** will exit this menu. Alternatively sample time can be changed through default selection.

Skip and Blowback

Sample lines can be skipped during maintenance and blowback can be inhibited on certain sample lines to prevent oxygen being supplied to an area or zone.
This menu shows the sample line which can be altered, use **UP** and **DOWN** to change the sample line and then use **ENTER** to toggle skip Y or N and use **SCROLL** to toggle blowback Y or N.
SELECT will exit the menu.
If a sample line is skipped (Y) then the skipped LED on the front panel will illuminate to indicate this condition.

Alter Sequence

Sample lines do not have to be in strict 1 to 48 order and some lines can be sampled more often than others. Eg cabgas line 48 when used.
A sequence memory of 144 is available and by default it is set as 1 to 48 three times.
Using **UP** and **DOWN**, alter the sequence number and adjust the line being sampled using **ENTER** and **SCROLL**. **SELECT** will exit the menu.
In systems which have only a few sample lines it may not be required to enter all 144 sequence options and so whilst adjusting the sample line the option to GO-TO sequence 1 will appear. If chosen, when the sequence gets to this point it will automatically reset the sequence to 1 and use that sample line. Thus any sequence entries past this point are ignored.

Alter Line Text

Each sample line has text associated with it to describe its location.
This text can be altered manually if required using this menu.
Use **UP** and **DOWN** to choose the line to be edited and then press **ENTER** to go into edit mode. A small cursor will appear below the text indicating that the character above it can be altered. Use **ENTER** and **SCROLL** to change the character and use **UP** and **DOWN** to move the cursor to another character position.
SELECT will complete the editing and return to choose another line.
SELECT again at this point will exit the menu.
Note: using a PC to **PANEL** allows this text to be loaded from a PC which is much quicker.

Alter Gas Type

Up to four Direct 4-20mA gasses can be measured and the gas type can be selected using this menu. Use **UP** and **DOWN** to choose which of the four gasses to change and then use **ENTER** and **SCROLL** to change the gas type. The default alarm levels are displayed which will be used if the gas is changed to a new type.
Note: that most alarms are rising but in the case of oxygen, three alarm options are possible indicated by the $_{v}$ and ^ characters.

Alter Blowtime

Periodically, each of the sample lines will be blown back with compressed air (if allowed) and the time for blowback can be set in seconds. Longer sample lines may need longer blowback times. The default value is just two seconds but can be altered using **SCROLL** and **ENTER** whilst **UP** and **DOWN** choose another sample line.
The presence or otherwise of the valve on this sample line is also shown on the LCD.
SELECT will exit from this menu.

Adjust zero and span

Normally a gas sensor will be calibrated as a separate item but minor adjustments to the readings of any of the four Direct 4-20mA gasses can be made at the panel using this menu. Use **UP** and **DOWN** initially to choose the gas sensor to be calibrated.
Then press **SELECT** and use **UP** and **DOWN** to alter the maximum value of the sensor if required. Then press **SELECT** to start adjusting the zero for this sensor (with no gas present).
UP and **DOWN** make minor adjustments and when reading of zero is achieved press **SELECT** to move to a span adjustment (apply span gas). **UP** and **DOWN** will adjust the internal gain to make the reading correct according to the span gas applied.
Press **SELECT** to exit this menu.

Alter Sequence

Sample lines do not have to be in strict 1 to 48 order and some lines can be sampled more often than others. Eg cabgas line 48 when used.
A sequence memory of 144 is available and by default it is set as 1 to 48 three times.
Using **UP** and **DOWN**, alter the sequence number and adjust the line being sampled using **ENTER** and **SCROLL**. **SELECT** will exit the menu.
In systems which have only a few sample lines it may not be required to enter all 144 sequence options and so whilst adjusting the sample line the option to GO-TO sequence 1 will appear. If chosen, when the sequence gets to this point it will automatically reset the sequence to 1 and use that sample line. Thus any sequence entries past this point are ignored.

Alter Line Text

Each sample line has text associated with it to describe its location.
This text can be altered manually if required using this menu.
Use **UP** and **DOWN** to choose the line to be edited and then press **ENTER** to go into edit mode. A small cursor will appear below the text indicating that the character above it can be altered. Use **ENTER** and **SCROLL** to change the character and use **UP** and **DOWN** to move the cursor to another character position.
SELECT will complete the editing and return to choose another line.
SELECT again at this point will exit the menu.
Note: using a PC to **PANEL** allows this text to be loaded from a PC which is much quicker.

Alter Gas Type

Up to four Direct 4-20mA gasses can be measured and the gas type can be selected using this menu. Use **UP** and **DOWN** to choose which of the four gasses to change and then use **ENTER** and **SCROLL** to change the gas type. The default alarm levels are displayed which will be used if the gas is changed to a new type.
Note: that most alarms are rising but in the case of oxygen, three alarm options are possible indicated by the $_{v}$ and ^ characters.

Alter Blowtime

Periodically, each of the sample lines will be blown back with compressed air (if allowed) and the time for blowback can be set in seconds. Longer sample lines may need longer blowback times. The default value is just two seconds but can be altered using **SCROLL** and **ENTER** whilst **UP** and **DOWN** choose another sample line.
The presence or otherwise of the valve on this sample line is also shown on the LCD.
SELECT will exit from this menu.

Adjust zero and span

Normally a gas sensor will be calibrated as a separate item but minor adjustments to the readings of any of the four Direct 4-20mA gasses can be made at the panel using this menu. Use **UP** and **DOWN** initially to choose the gas sensor to be calibrated.
Then press **SELECT** and use **UP** and **DOWN** to alter the maximum value of the sensor if required. Then press **SELECT** to start adjusting the zero for this sensor (with no gas present).
UP and **DOWN** make minor adjustments and when reading of zero is achieved press **SELECT** to move to a span adjustment (apply span gas). **UP** and **DOWN** will adjust the internal gain to make the reading correct according to the span gas applied.
Press **SELECT** to exit this menu.

Set alarm levels

Alarms occur when the gas values for each sensor are above or below these alarm levels (Oxygen can be below) and the level can be adjusted using this menu.
Note: that the CAN sensor alarms exist both in the sensor and at the panel so changing at the panel will send the new values to the sensor and vice versa.
Additionally, the low and high alarms can be latched or unlatched and on entering this menu, you have to select whether low alarms are latched. Pressing **ENTER** will toggle between latched and unlatched.
Pressing **SELECT** allows the same choice for the high alarm.
Pressing **SELECT** again allows adjustment of the low alarm using the **UP** and **DOWN** buttons.
Pressing **SELECT** again allows adjustment of the high alarm using the **UP** and **DOWN** buttons.
Pressing **SELECT** again allows adjustment of the over range alarm using the **UP** and **DOWN** buttons.
Pressing **SELECT** again will exit the menu.

Low alarm buzzer

Particularly when the low alarm is unlatched, it is required that the internal sounder is not audible to eliminate a nuisance problem. This menu allows you to toggle this option.
By default the sounder is active but by using **ENTER**, it can be made inactive (not in use).
Pressing **SELECT** will exit this menu.

Event to relay

Each event which is stored in the 99 event log can also activate a relay.
Use this menu to choose which relay.
Use **UP** and **DOWN** to choose the event (which is displayed on the LCD) and then use **SCROLL** and **ENTER** to choose which of the 64 relays to drive.
The default is to not to drive any relay.
Pressing **SELECT** will exit this menu.

Manual Blowback

When dealing with a sample line which has a major blockage, it is sometimes required to continuously blow back a particular line (regardless of whether blowback is allowed).
Use this menu to choose a sample line using **UP** and **DOWN** buttons and **ENTER** will toggle the blowback on or off for that sample line.
Pressing **SELECT** will exit this menu.

Cabgas source

Gas which has leaked into the cabinet may be flammable and as such is monitored and can cause a shutdown of the whole system using the dedicated cabgas relay.
Use this menu to decide how it is to be measured if at all.
Pressing **ENTER** toggles the three options which are:

4-20 mA input from a local flammable sensor such as Pellistor

or

from sample line 48 and gas sensor 1 which is assumed to be a flammable type

or

not in use which may be the case if no flammable gasses are possible.

The first option is preferred since this is quick acting.
The second option is cheaper because it uses an existing sensor but it has the disadvantage of taking a long time to detect the problem depending how the sample sequence has been set.
Pressing **SELECT** will exit this menu.

Default Sequence

Sometimes it is required to restore the sequence to a known default state and this menu will allow you to do this. Pressing **ENTER** will make the sequence 1 to 48 (three times) to make a total sequence of 144.
Pressing **SELECT** will exit this menu.

Setup Network

Both Modbus and Canbus require that this panel has a communication address and this can be set using this menu.
UP and **DOWN** change the displayed address which is common to both bus systems.
Pressing **SELECT** changes the display to view of all Canbus devices currently connected to this panel. The purpose of this is to find an address which has a repeater panel and then to decide if this panel should be connected to it.
The address is displayed together with the type of device seen.
A ? is displayed if nothing is present at the displayed address.
The letter P would appear if another panel was seen.
The letter R would appear for a repeater and The Y/N letter states whether this panel is currently connected to it. **ENTER** toggles this connection. Once connected, this panel's functions as far as the LED's, the LCD and buttons, are functional on the repeater exactly the same as on this panel.
Pressing **SELECT** will exit this menu.

Event log to PC

It is possible to send the event log to a PC for storage etc.
Using Hyper-terminal on the PC configure to 1200 baud, 8bit, no parity, no flow control.
The events are sent one by one in ASCII characters to the PC using the RS232 connection.
The Hyper-terminal can be set to capture text and then save it. The file sent is text only and can be printed or edited as required. This menu will exit automatically when all data is sent.

Data PC to Panel

To get data from a PC to this panel to set up Text, Gasses, Alarms, and Sequence, this menu prompts you to set up Hyper-terminal on your PC and then waits for data to be sent in a prescribed format ending in :x.
When the text has been sent, any valid data is stored. Bad data and comments are ignored. Valid command letters only are echoed to the PC screen.
This menu will drop out if data is not sent in 60 seconds and also can be aborted by pressing **SELECT**.

Data Panel to PC

The panel may already have Text Gas alarms and sequence data stored and you may wish to have a copy held on the PC for future backup.
This menu allows you to send this data and the PC will receive it in Hyper-terminal using Capture text.
When saved on the PC, this text can then be edited using a simple text editor (Notebook) and then sent back to the panel if required.
Pressing **SELECT** starts sending the data to the PC and when finished, this menu will exit automatically.

Clear the event Log

This menu allows you to clear the event log by pressing **ENTER**. Pressing **SELECT** will exit the menu.
When cleared, the event log has only one entry which is the event of clearing itself.
When cleared, this menu will exit automatically.

Default Sections

Sometimes it is required to default part of the data in the panel and this menu allows you to do this. (some options are repeats of other menus)
Pressing **SELECT** moves to the next option and pressing **ENTER** defaults the option displayed.
The options are:

- Clear event log
- Default Modbus/Canbus
- Default gas type to Flam
- Default Line text
- Default event to relay
- Default sample and blowback time

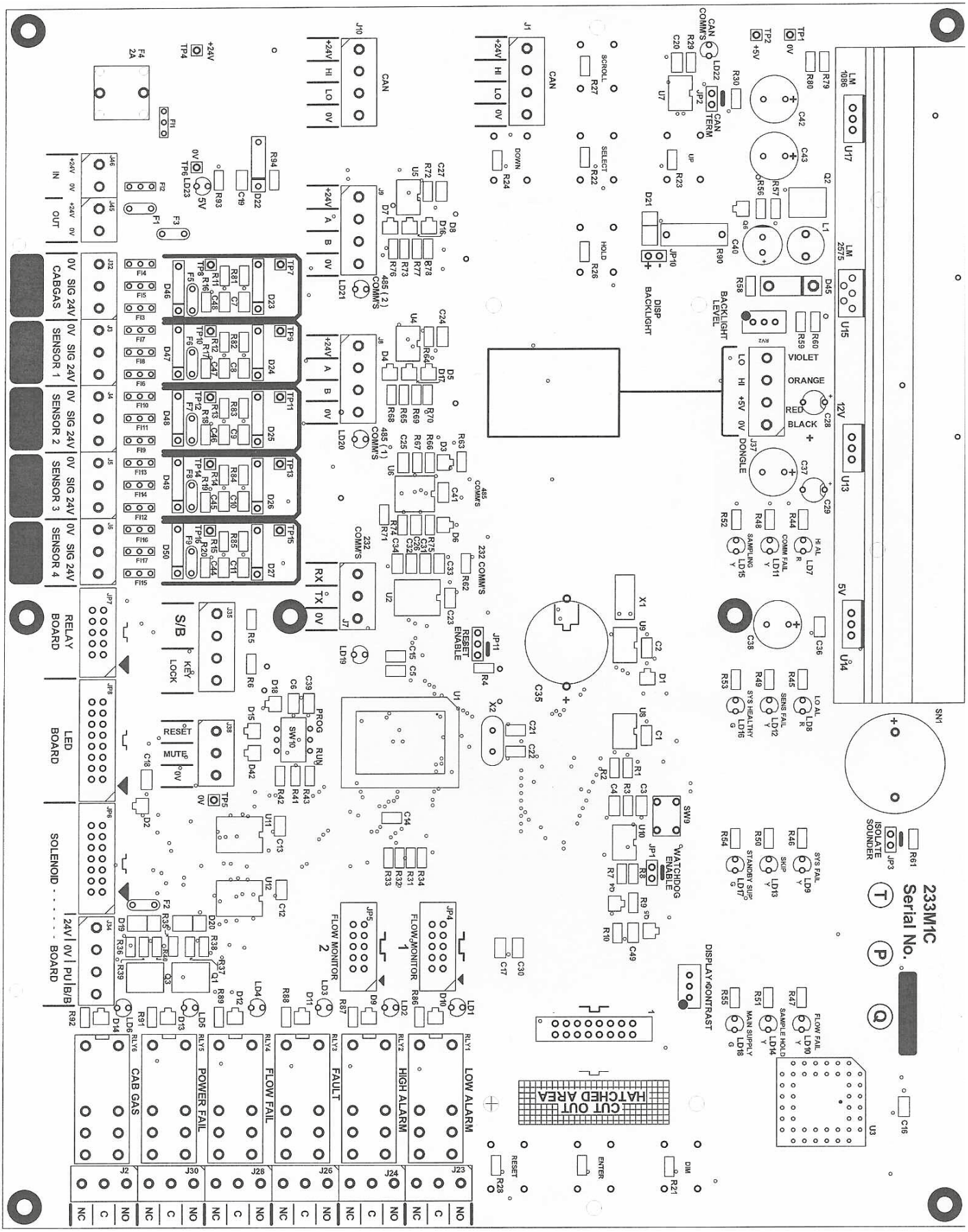
Change user code

The user password code can be changed to a new number.
Prompted to enter a new code twice via the buttons, this menu changes that code.
The Engineers code is unchanged.
Pressing select will exit this menu.

Set Modbus Baud

This menu allows you to change the Baud rate used by the modbus.(default is 9600)
The options are 19200, 9600, 4800 bits per second and these are altered using the UP and DOWN buttons,
Pressing SELECT will exit from this menu.

CIRCUIT BOARD DETAILS FIG.1A



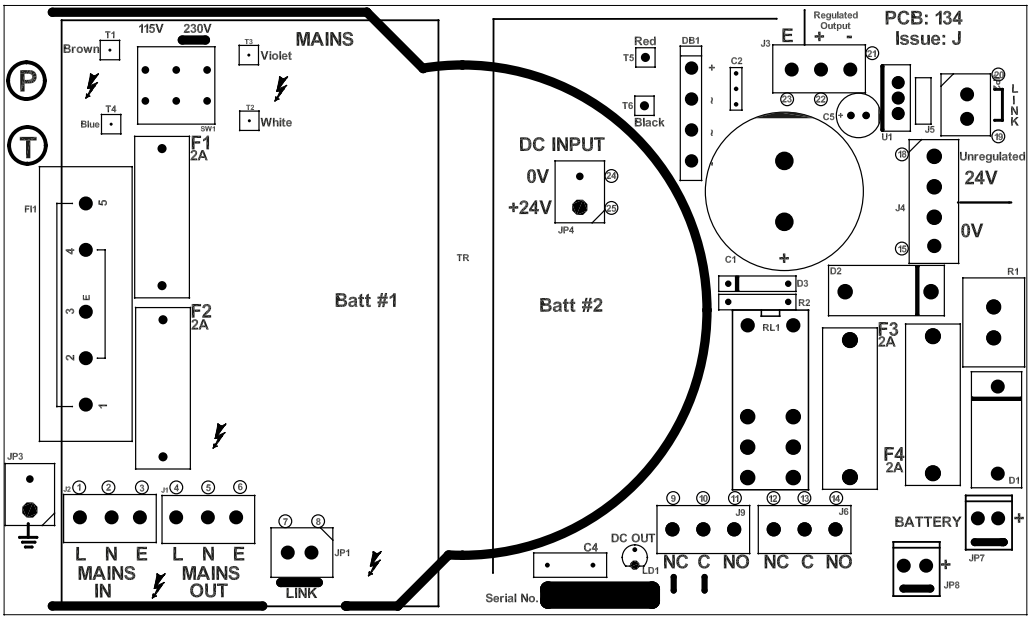


Fig 1B
(Item 3)

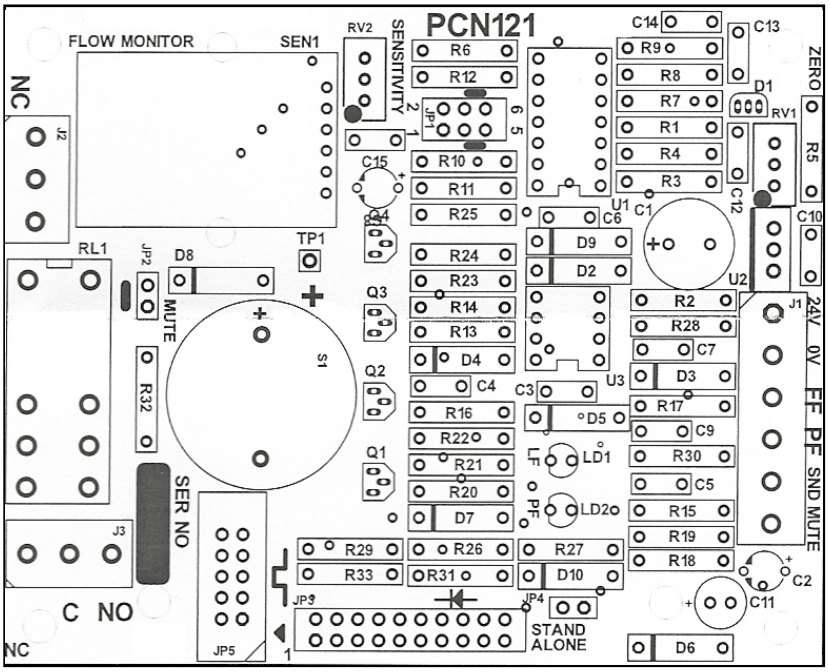


Fig 1C
(Item 11)

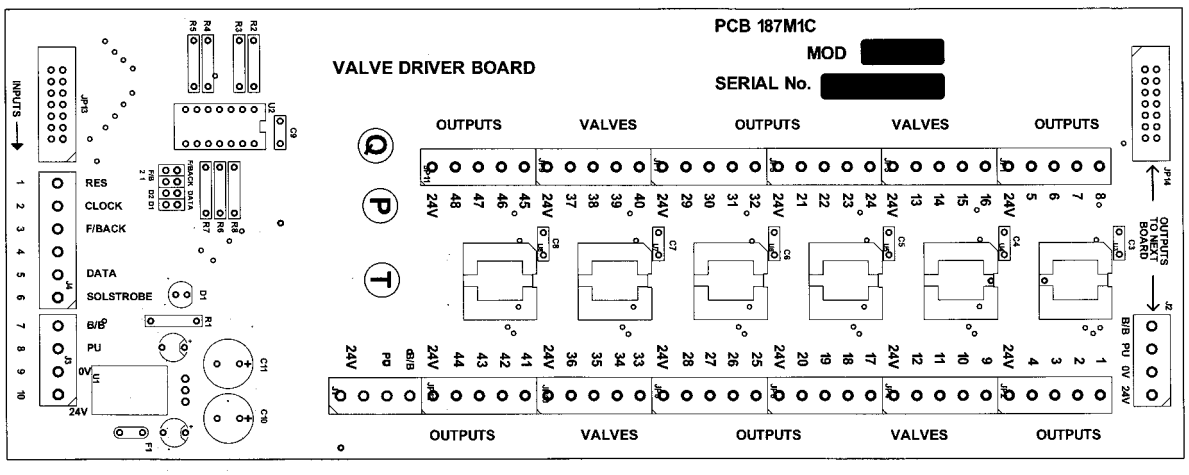
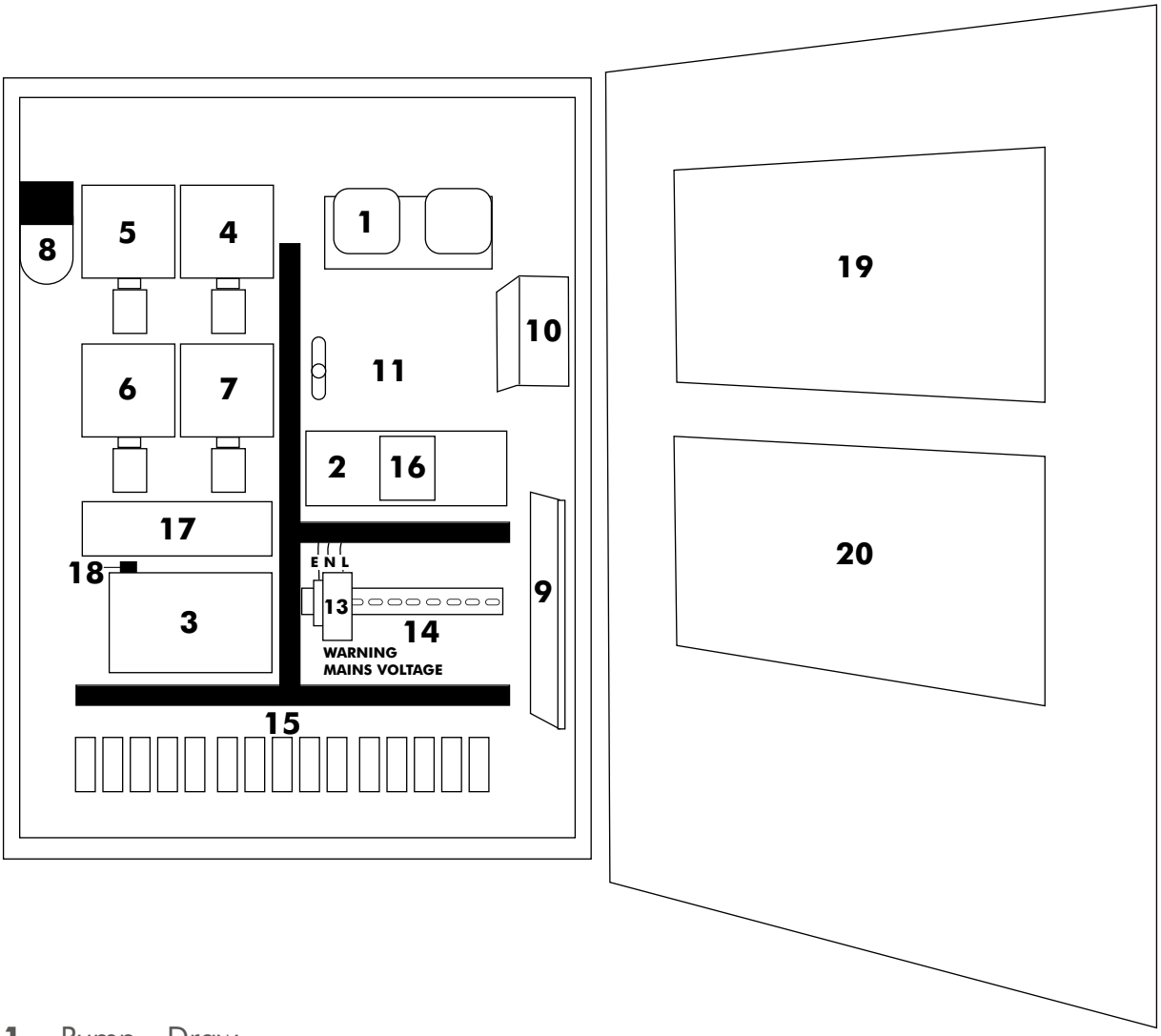


Fig 1D
(Item 2)

INTERNAL COMPONENT LAYOUT

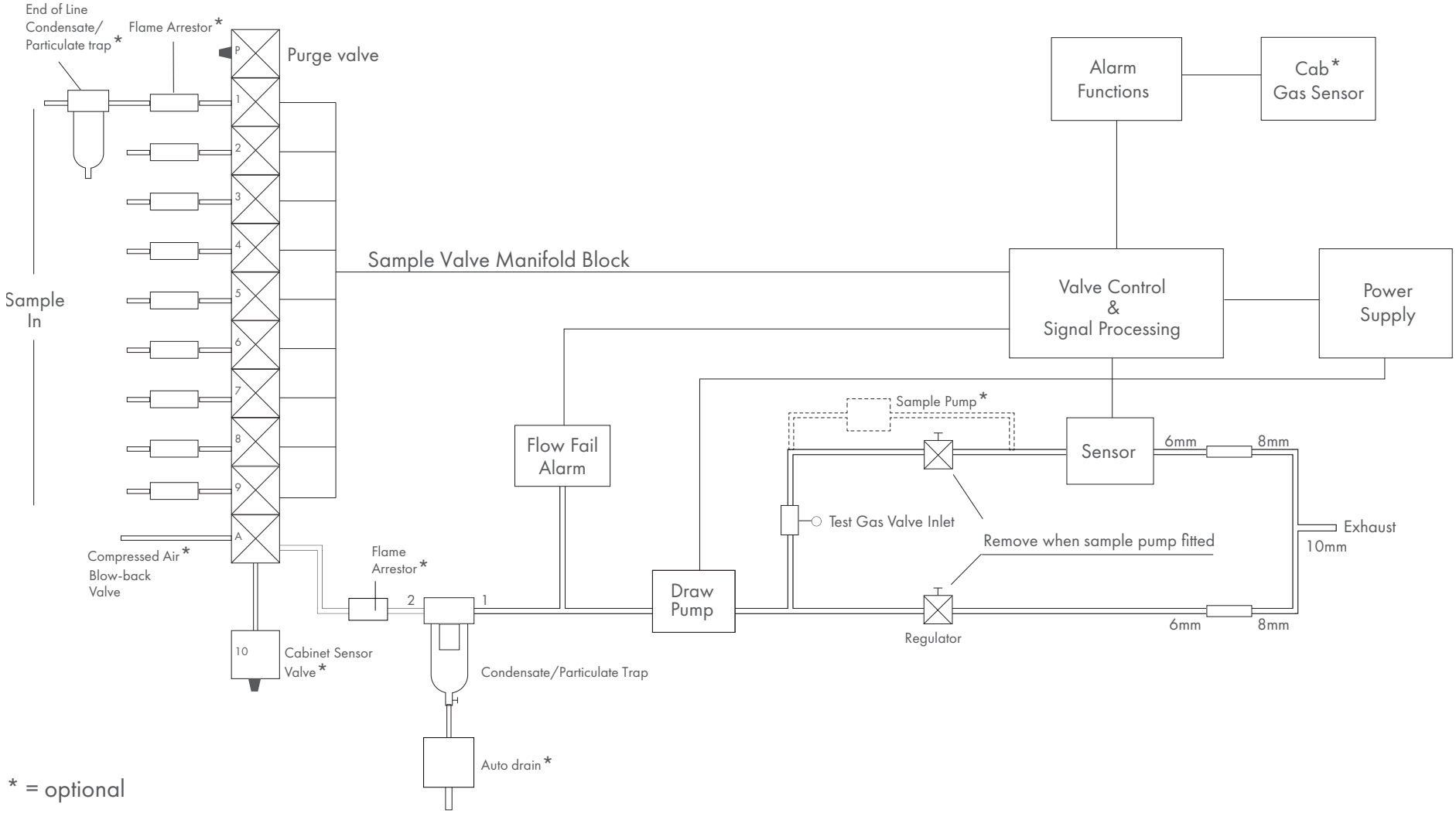


1 Pump - Draw
2 Valve driver board see fig. 1D page 32
3 Power supply see fig. 1B page 32
4, 5, 6, 7 - Sensor options 1~4
8 Water trap, when fitted, left side mounting
9 Relay board 32 way, when fitted, right side mounting
10 Cabinet sensor, when fitted, right side mounting
11 Test gas valve
12 Trunking
13 Mains input terminals (Mains)
14 Din rail - spare
15 Sample valves 1~48
16 Flow monitor see fig. 1C page 32
17 Area for specials
18 System reset switch
19 Main board see fig. 1A page 31
20 Indicator board when fitted - door mount

GasVac Sequential Sampler

GAS SAMPLE PATH

Doc No. G1480



* = optional

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